INTRODUCTION TO THE RASPBERRY PI

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Introduction to the Raspberry PI

KEY TO THIS PROGRAM

If you like this program:

Fall asleep with your head forward

If you dislike this program:

Fall asleep with your head backward.

All the heads should be forward

when I am finished :-)

PROGRAM OUTLINE

I. HISTORY OF THE RASPBERRY PI.

II. CURRENT RASPBERRY PI PRODUCTS.

III. WHAT IS NEEDED TO ACTIVATE YOUR RASPBERRY PI.

IV. RASPBERRY PI ACCESSORIES.

V. RANKING OF THE RASPBERRY PI.

VI. SAMPLE PROJECT USING THE PI.

I. HISTORY OF THE RASPBERRY PI

- Eben Upton, who first came up with the idea based upon a computer he had built with an Atmel AVR controller.

- Upton wanted to see a small and inexpensive computer for undergraduate college students to learn programming skills, similar to the BBC Micro that he had learned programming on in the 1980's as a teenager.

I. HISTORY OF THE RASPBERRY PI

- Upton, an ASIC designer at Broadcom, pulled together a team of engineers at Broadcom and students from Cambridge University and completed the first Raspberry PI design in 2011.

I. HISTORY OF THE RASPBERRY PI

- The name Raspberry PI came from the tradition of naming computer prototypes after fruit. The PI is short for the Python programming language, the first programming language used in the PI.

I. HISTORY OF THE RASPBERRY PI

- For an interview with Eben Upton on the creation of the Raspberry PI:

  https://www.techspot.com/article/531-eben-upton-interview/

- For an interesting video on the creation of the Raspberry PI: https://youtu.be/UCt6d0SCxO4?t=27.

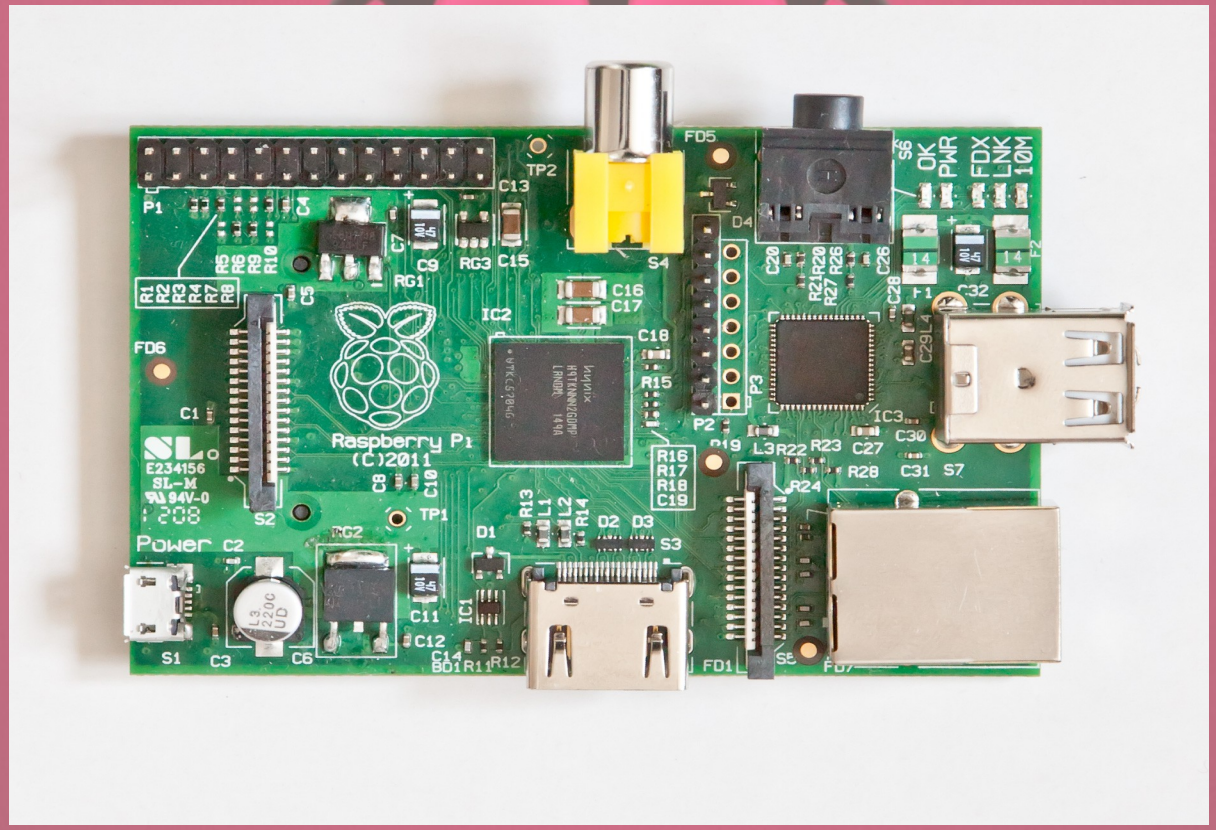
I. HISTORY OF THE RASPBERRY PI

- Originally developed in 2011 and released in February 2012
- Came out in Models A and Model B for $25 and $35 respectively.
- Improved versions, labeled Raspberry PI B+ and A+ were released in 2014 with 512 MB of RAM

I. HISTORY OF THE RASPBERRY PI

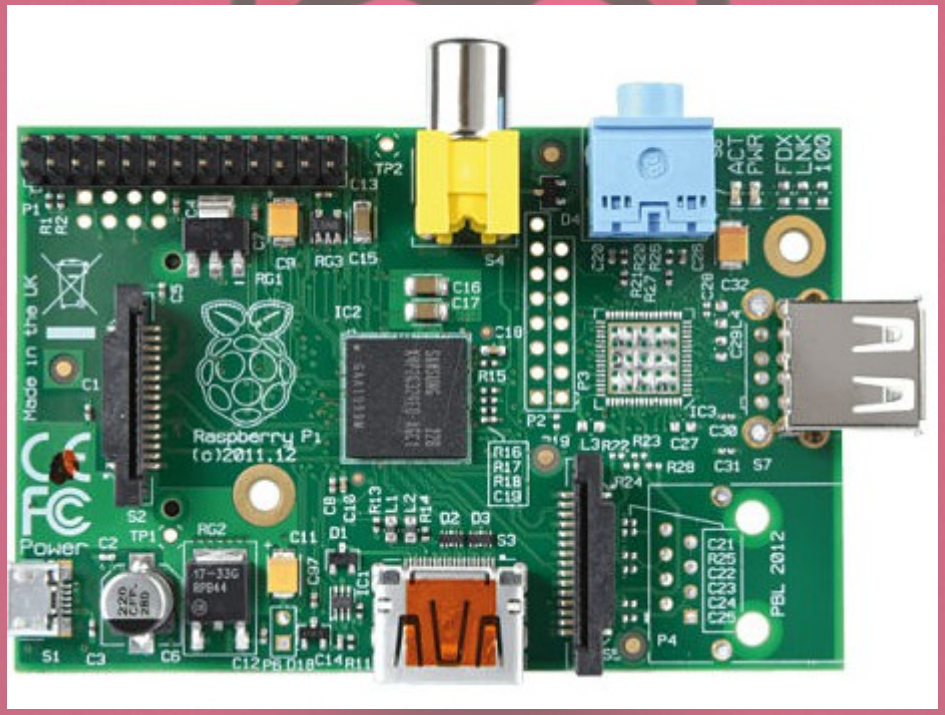
Original Raspberry Raspberry PI Model B

256 MB of RAM



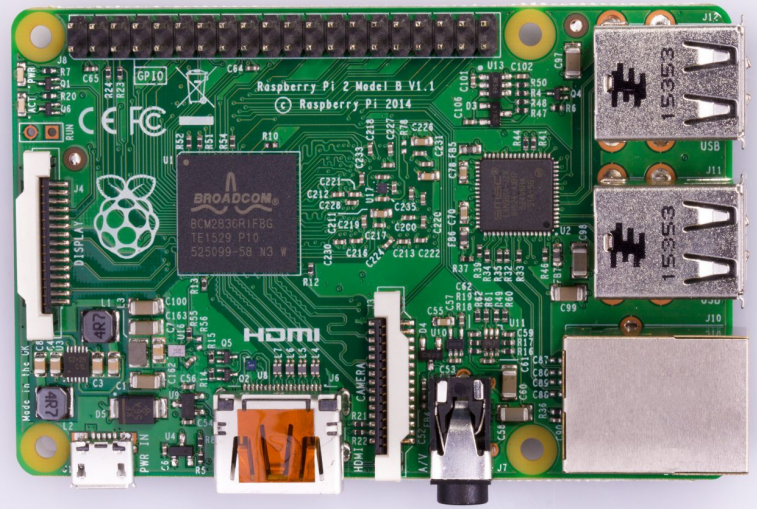
I. HISTORY OF THE RASPBERRY PI

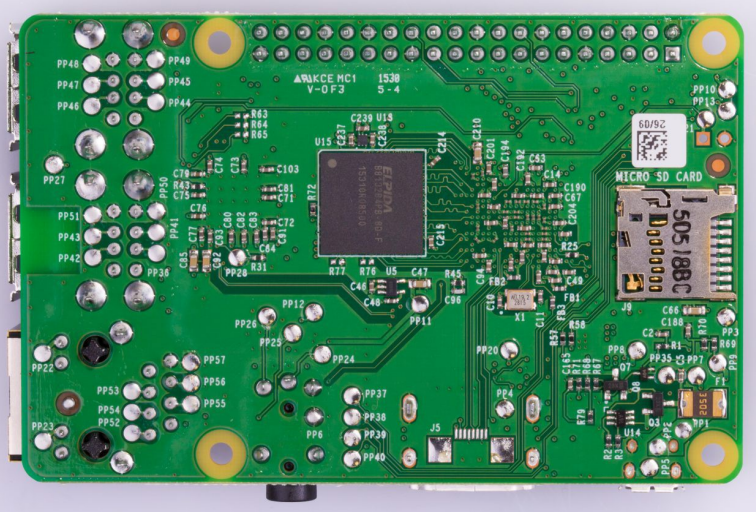
Original Raspberry PI Model A



I. HISTORY OF THE RASPBERRY PI

The Raspberry PI 2 was released in February 2015.





I. HISTORY OF THE RASPBERRY PI

The Raspberry PI 2 provided the following improvements:

- Changed the processor from a Broadcom 2835 (ARM6) to a Broadcom 2836 (ARM7).
- Quad Core Processor instead of Single Core.
- A CPU speed increase from 700 MHz

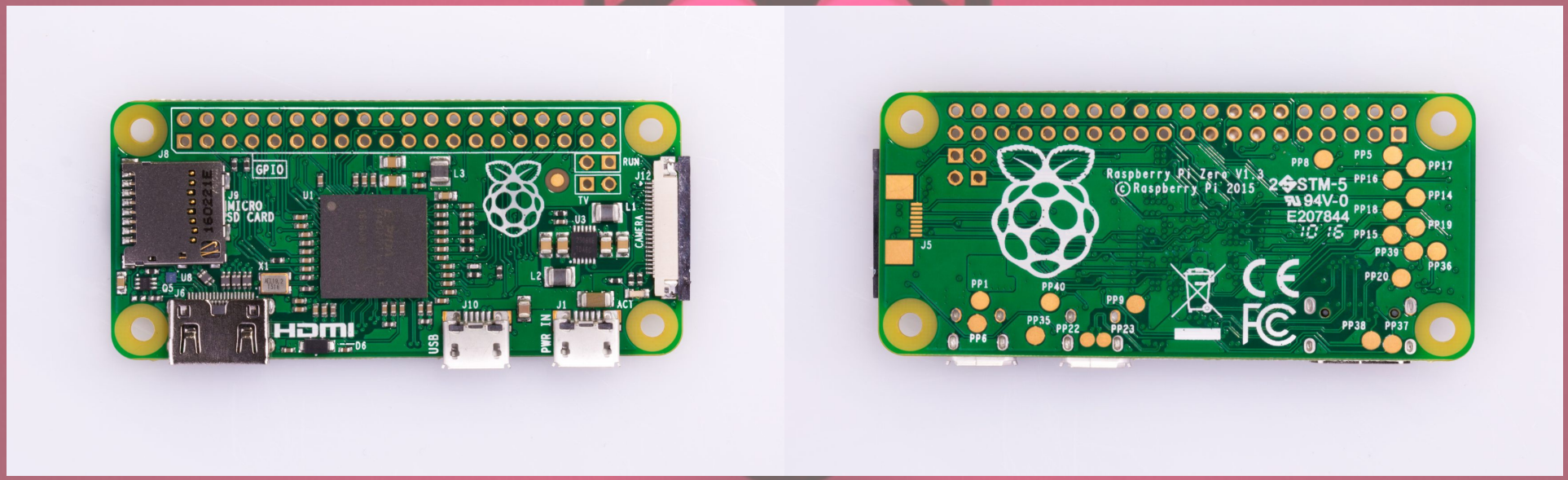
I. HISTORY OF THE RASPBERRY PI

The Raspberry PI 2 provided the following improvements:

- Addition of 2 more USB ports.
- Increased the GPIO header from 26 pins to 40 pins, providing more I/O ports.
- Changed the SD card slot from full size SD to micro SD slot.

I. HISTORY OF THE RASPBERRY PI

The Raspberry Pi Zero was released in November 2015



A free Raspberry Pi Zero was included in every issue of the MagPi.

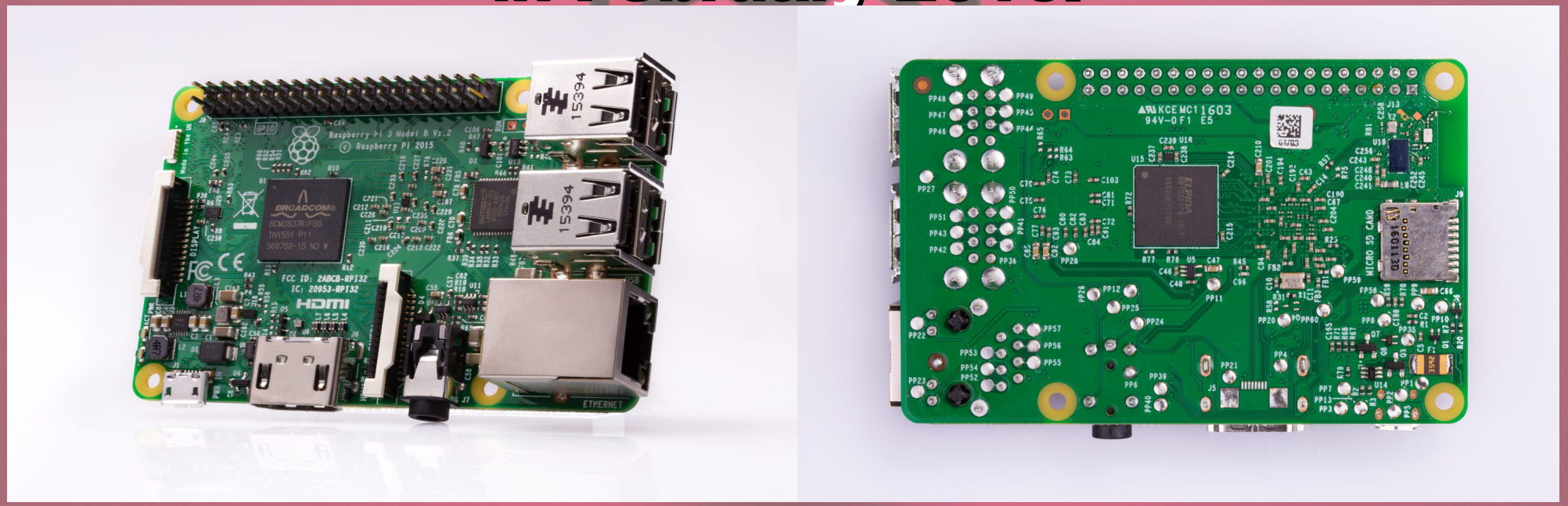
I. HISTORY OF THE RASPBERRY PI

The Raspberry PI Zero was targeted differently:

- Designed to draw only 160mA of current.
- The main 40 pin header and the composite video headers are not soldered in. End user adds what is needed to his design.
- Also uses microHDMI video connector instead of full size HDMI connector.

I. HISTORY OF THE RASPBERRY PI

The Raspberry PI 3 was released in February 2016.



I. HISTORY OF THE RASPBERRY PI

The Raspberry PI 3 provided the following improvements:

- **Changed the processor from a Broadcom BCM2836 (ARM7) to a Broadcom BCM2837 (ARM Cortex A53 with ARM8 Architecture).**
- **A speed increase to 1.2 GHz.**
- **Onboard WiFi and Bluetooth transceivers.**

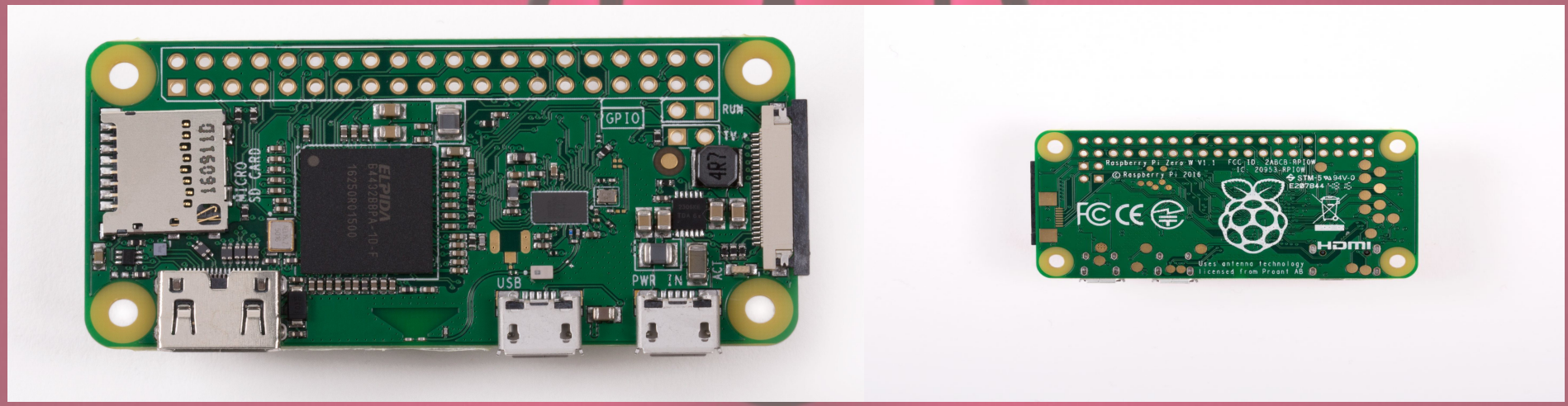
I. HISTORY OF THE RASPBERRY PI

The Raspberry PI 3 provided the following improvements:

- **This provided 1GB of RAM instead of 512MB.**
- **Now capable of running Windows 10 embedded as well as Linux.**

I. HISTORY OF THE RASPBERRY PI.

The Raspberry PI Zero W (for Wireless) was released in February of 2017.



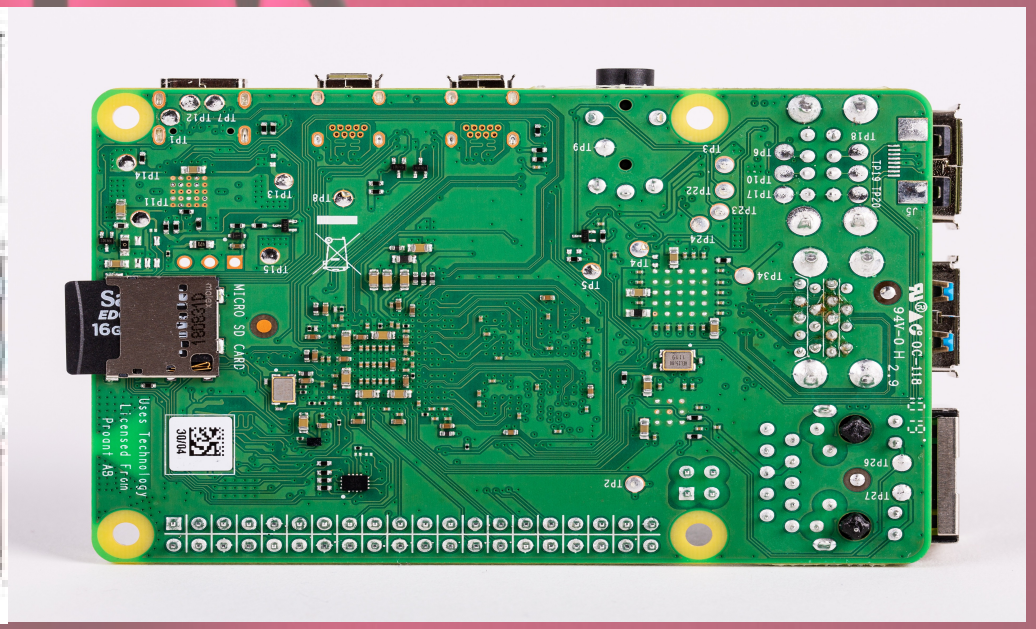
I. HISTORY OF THE RASPBERRY PI

The Raspberry PI Zero W provided the following improvements over the Raspberry Pi Zero:

- **Provided a WiFi and Bluetooth transceivers for wireless connectivity.**

I. HISTORY OF THE RASPBERRY PI

The Raspberry PI 4 was released in July 2019:



I. HISTORY OF THE RASPBERRY PI

The Raspberry PI 4 was released in July 2019:

- Another big step from the Raspberry PI 3
- Broadcom BCM2711, Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
- Available in 1GB, 2GB, or 4GB memory versions - $35, $45, $55 each version.
- Gigabit Ethernet
- (2) USB 3.0 Ports and (2) USB 2.0 Ports

II.CURRENT RASPBERRY PI PRODUCTS

The current line up of Raspberry products is as follows:

- Raspberry PI 1 Model B+
- Raspberry PI 1 Model A+
- Raspberry PI 2 Model B
- Raspberry PI 3 Model B
- Raspberry PI 4 Model B
- Raspberry PI Zero
- Raspberry PI Zero W

II.CURRENT RASPBERRY PI PRODUCTS

Raspberry PI Specifications Chart
(from the Hackaday Website)

	Raspberry Pi 3 Model B	Raspberry Pi Zero	Raspberry Pi 2 Model B	Raspberry Pi Model B+
Introduction Date	2/29/2016	11/25/2015	2/2/2015	7/14/2014
SoC	BCM2837	BCM2835	BCM2836	BCM2835
CPU	Quad Cortex A53 @ 1.2GHz	ARM11 @ 1GHz	Quad Cortex A7 @ 900MHz	ARM11 @ 700MHz
Instruction set	ARMv8-A	ARMv6	ARMv7-A	ARMv6
GPU	400MHz VideoCore IV	250MHz VideoCore IV	250MHz VideoCore IV	250MHz VideoCore IV
RAM	1GB SDRAM	512 MB SDRAM	1GB SDRAM	512MB SDRAM
Storage	micro-SD	micro-SD	micro-SD	micro-SD
Ethernet	10/100	none	10/100	10/100
Wireless	802.11n / Bluetooth 4.0	none	none	none
Video Output	HDMI / Composite	HDMI / Composite	HDMI / Composite	HDMI / Composite
Audio Output	HDMI / Headphone	HDMI	HDMI / Headphone	HDMI / Headphone
GPIO	40	40	40	40
Price	$35	$5	$35	$35

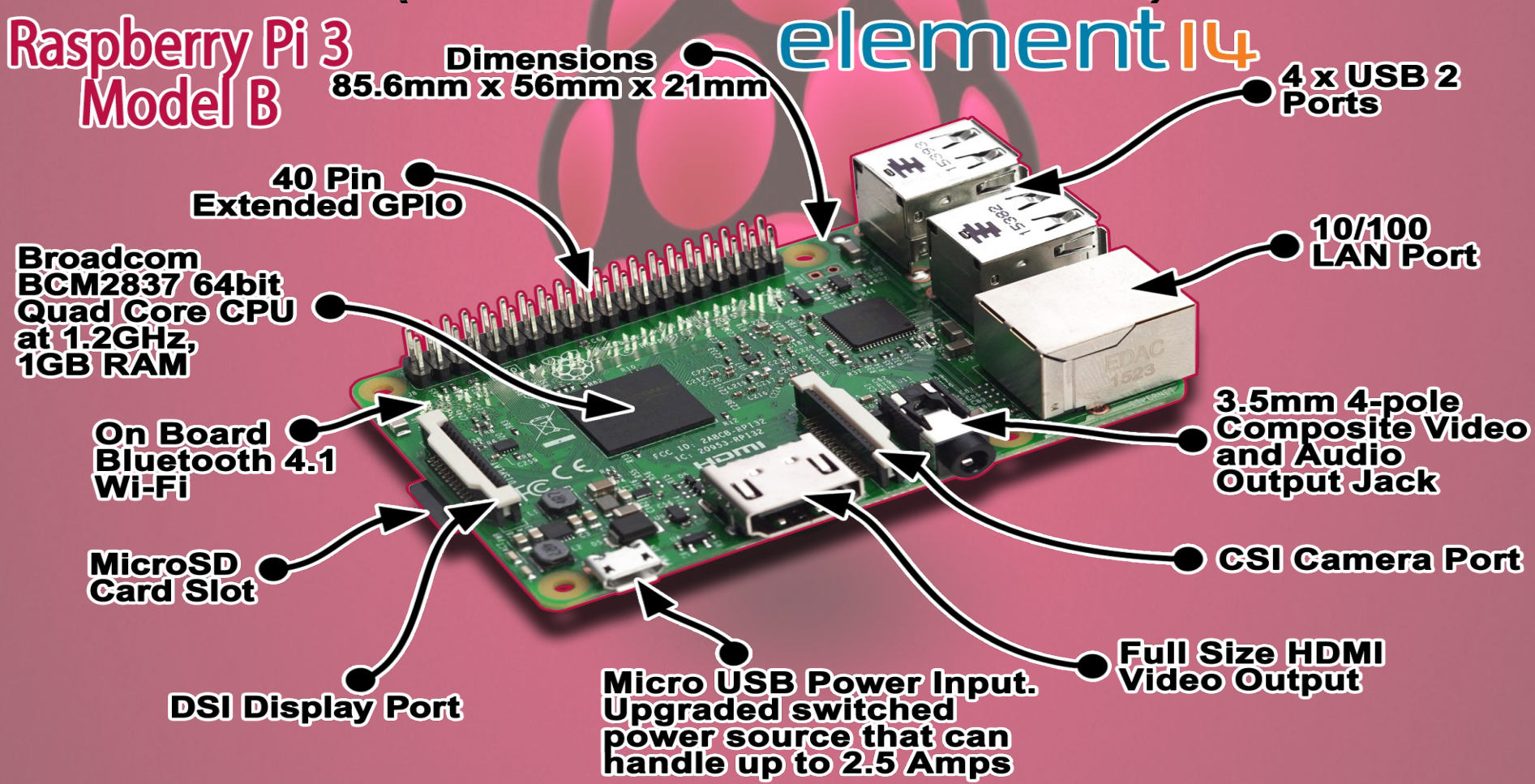
III.WHAT IS NEEDED TO ACTIVATE A RASPBERRY PI.

The following is needed to use the Raspberry PI:

- **A monitor: HDMI or touchscreen.**
- **A USB Mouse.**
- **A USB Keyboard.**
- **A microSD card.**
- **A microUSB based power supply.**

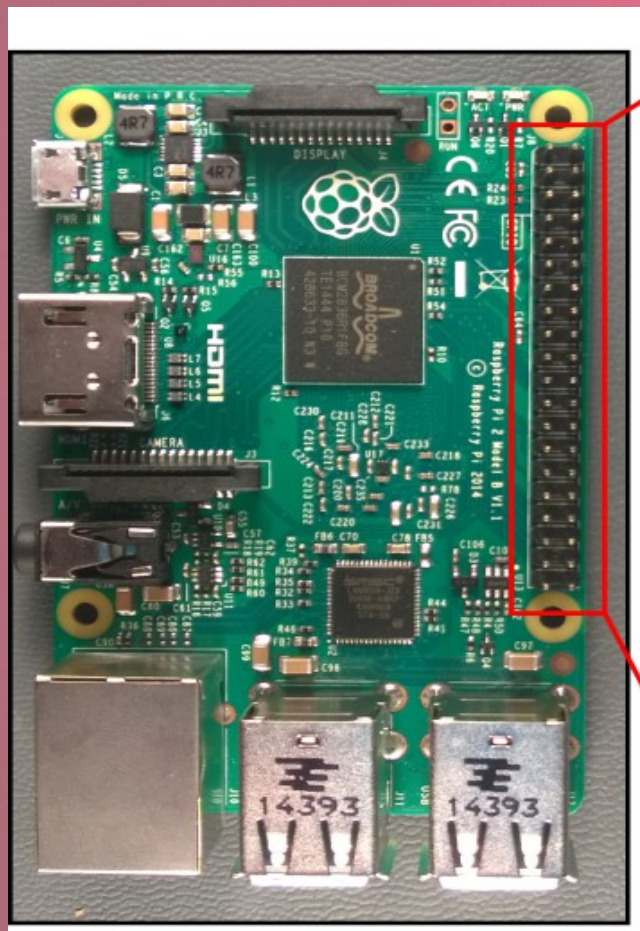
III.WHAT IS NEEDED TO ACTIVATE A RASPBERRY PI.

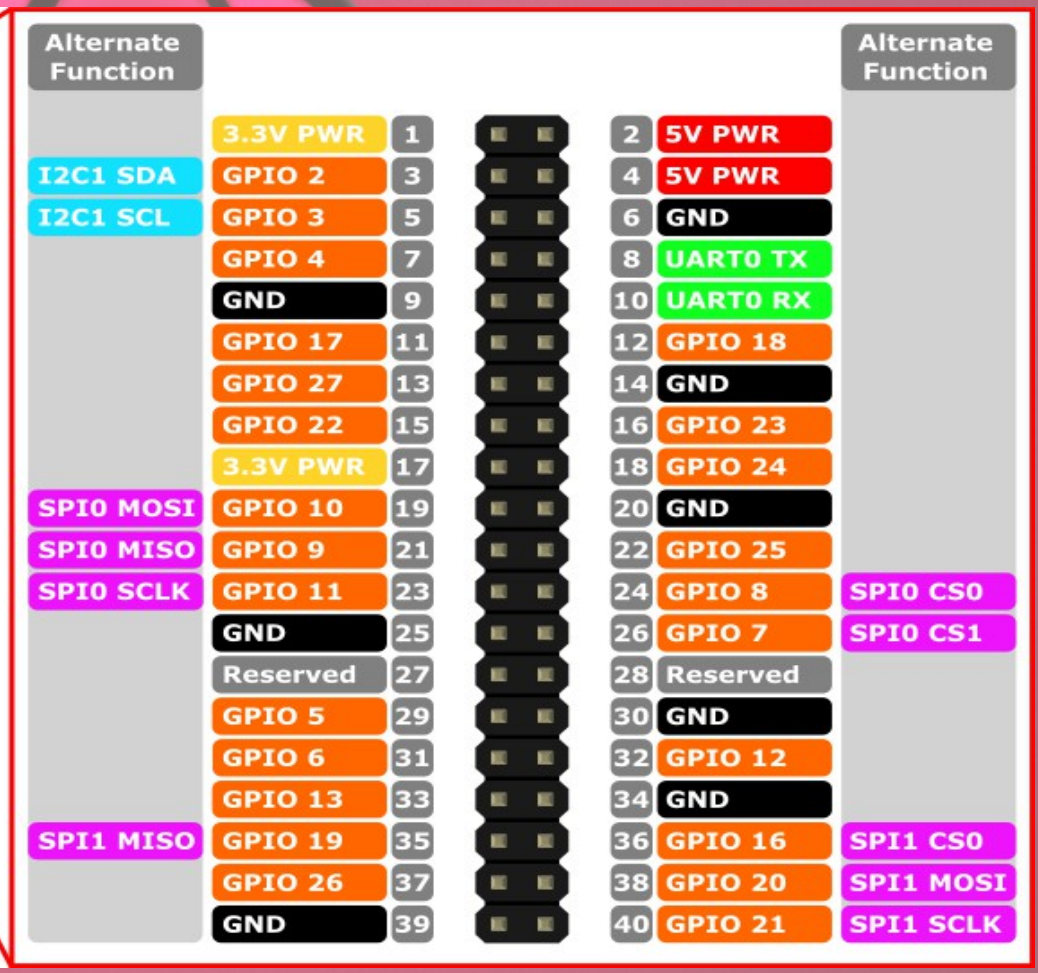
Raspberry PI hookup diagram:
(from the Element 14 website)



III.WHAT IS NEEDED TO ACTIVATE A RASPBERRY PI.

Raspberry PI 40 pin header diagram:



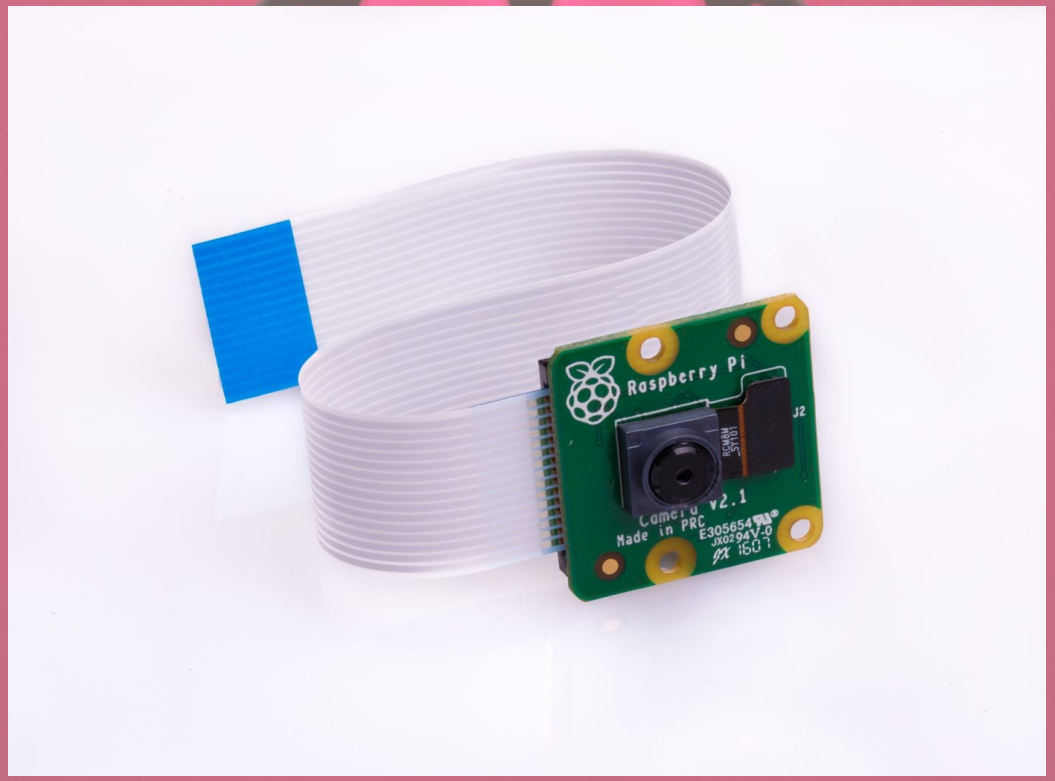


IV. RASPBERRY PI ACCESSORIES

Listed are some options for the Raspberry PI, no matter what flavor you have
that may be of use in your project

IV. RASPBERRY PI ACCESSORIES

CSI Camera Port – Raspberry PI camera



IV. RASPBERRY PI ACCESSORIES

DSI Screen Port – Raspberry 7”Touchscreen

IV. RASPBERRY PI ACCESSORIES

DSI Screen Port: Adafruit 4.3 inch screen

IV. RASPBERRY PI ACCESSORIES

HDMI Touchscreen:

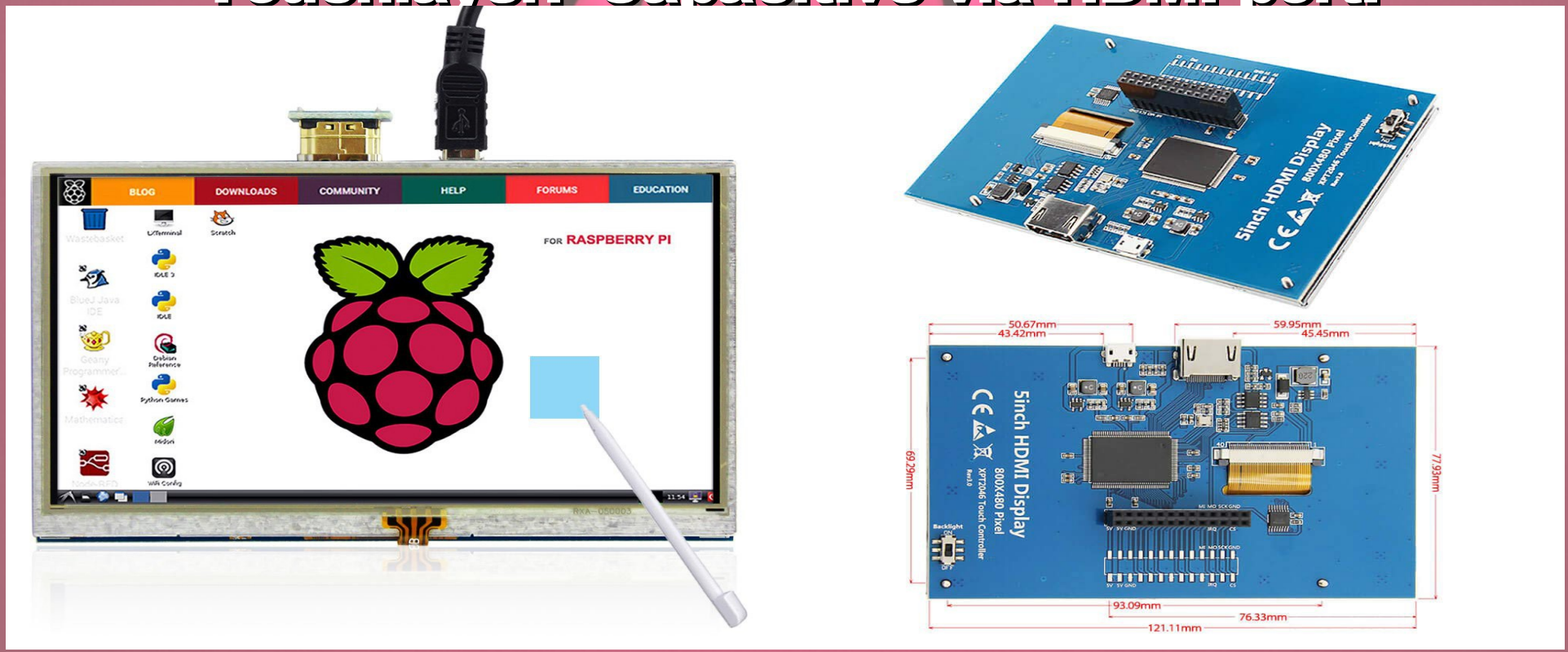
Official Raspberry PI 7”Touchscreen

IV. RASPBERRY PI ACCESSORIES

HDMI Touchscreen: Elecrow 5”Touchscreen

Resolution: 800 x 480 pixels

Touchlayer: Capacitive via HDMI port.

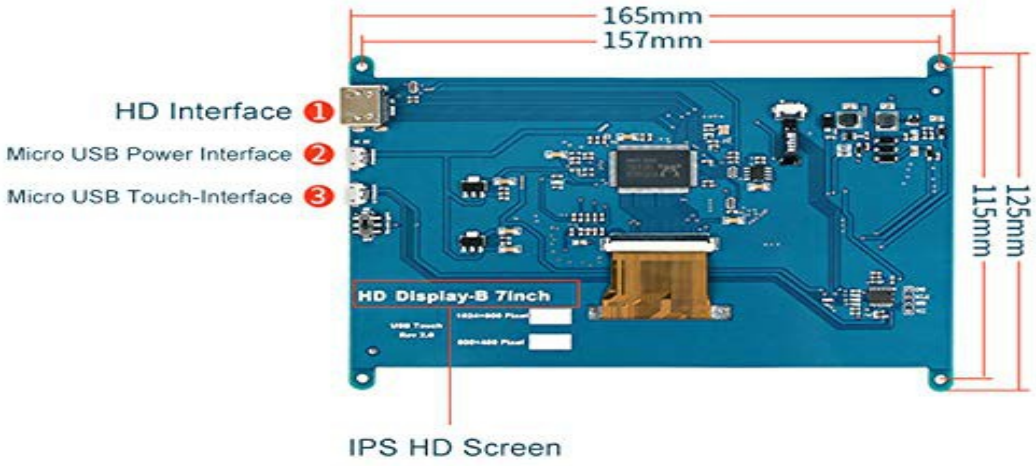


IV. RASPBERRY PI ACCESSORIES

HDMI Touchscreen: Aibecy 7”HD Touchscreen

Resolution: 1024 x 600 pixels

Touchlayer: Capacitive USB Interface



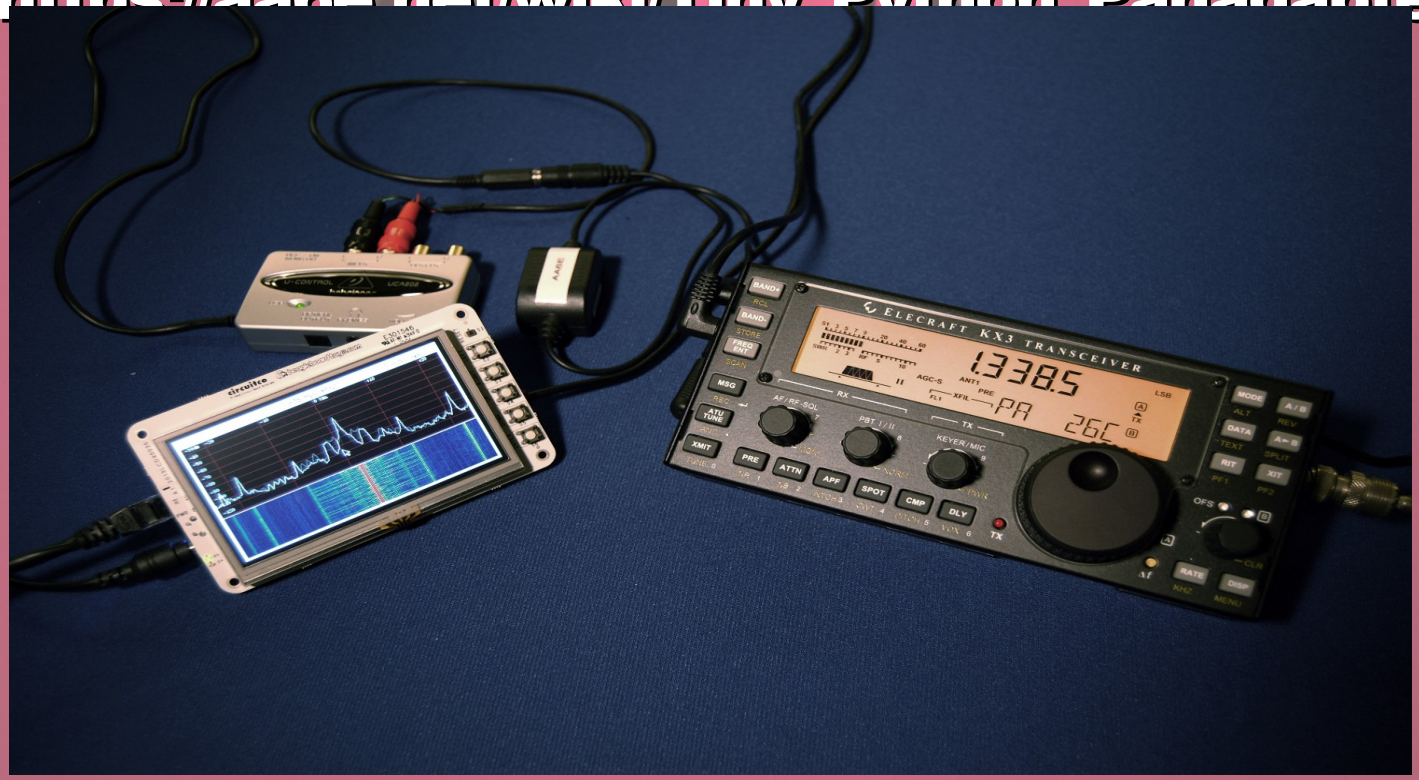
Note: It is normal for manual measurements to have slight deviations.

V. RANKING OF THE RASPBERRY PI.

Device:	Processor Capacity	CPU Speed	ROM (MEMORY)	RAM
Beaglebone Black	TI-AM3335 32 Bit	1 GHz	4 GB - Up	1GB – 2 GB
Raspberry PI	BCM2835 or BCM2835 32 Bit	700 MHz	4 GB - Up	256 MB – 1 GB
Arduino	AT Mega 328 8 Bit	8 - 16-MHz	8KB – 256 KB	512 Bytes – 8 KB
PICAXE	PIC 10, 12, 16 8 Bit	4 – 64 MHz	2KB - 4KB	128 – 256 Bytes
PIC	8 Bit and 16 Bit	4 – 20 MHz	Approx 512 Bytes – 64 KB	Approx 128 Bytes – 256 KB

VI. SAMPLE RASPBERRY PI PROJECTS

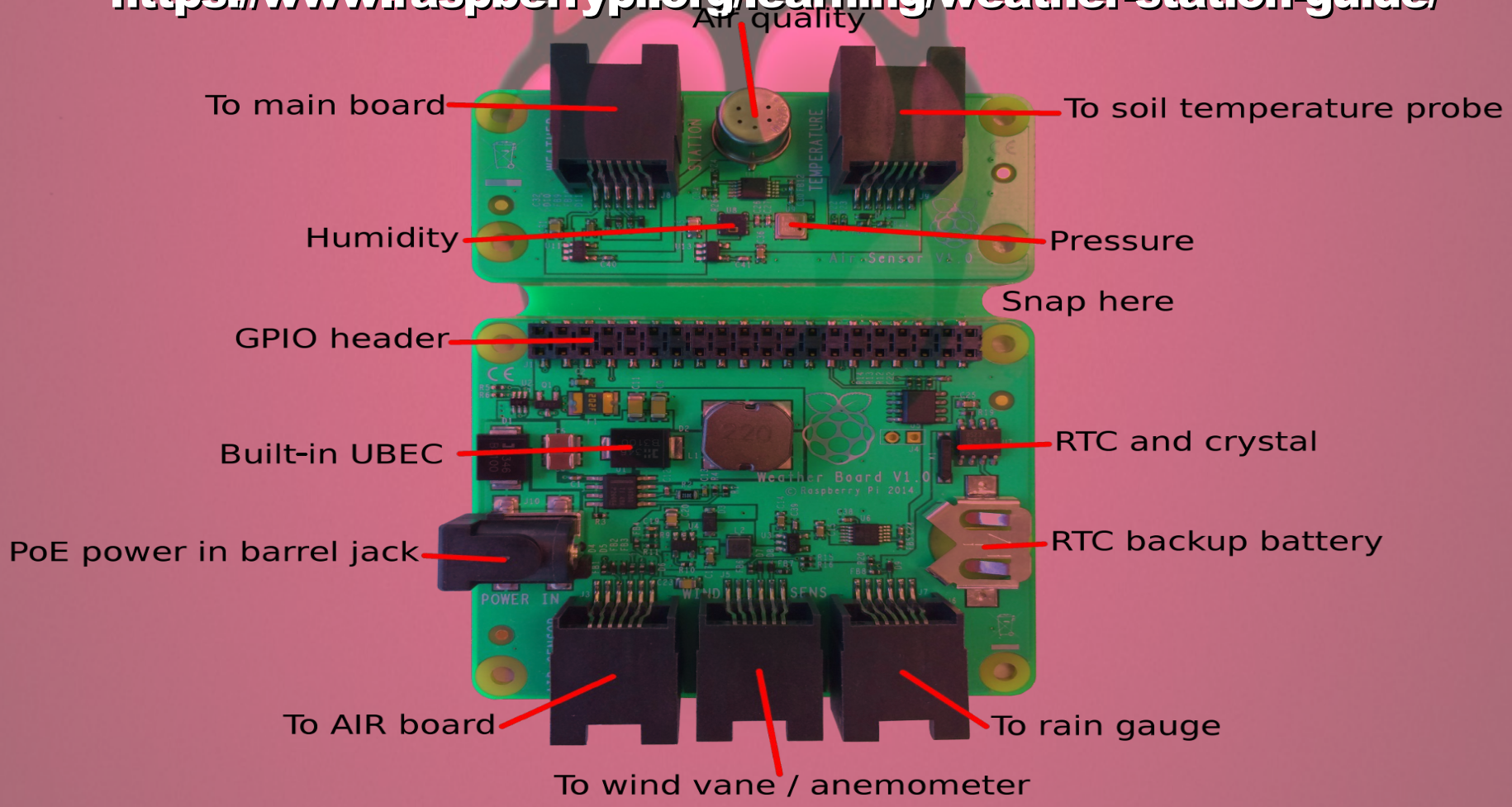
1. **Tiny Python Panadpater:**
   Martin Ewing AA6E – April 2014 QST
   https://aa6e.net/wiki/Tiny_Python_Panadapter



VI. SAMPLE RASPBERRY PI PROJECTS

2. Raspberry PI based weather station:

https://www.raspberrypi.org/learning/weather-station-guide/



VII. INSTALLING NOOBS ON A RASPBERRY PI

1. Download NOOBS from the Raspberry PI

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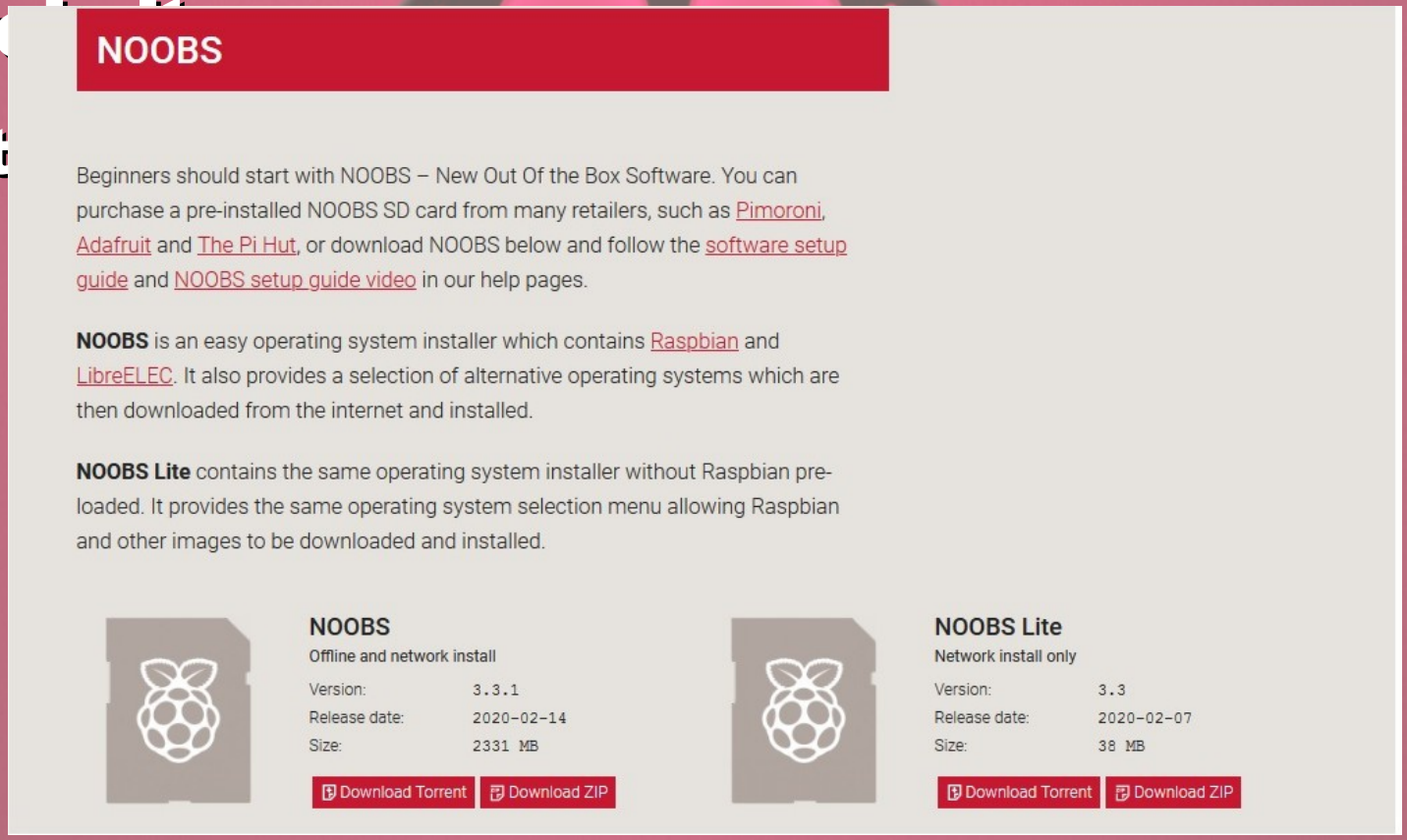


VII. INSTALLING NOOBS ON A RASPBERRY PI

2. Download SD Card Formater from SD Card Association website and install it:

https://www.sdcard.org/downloads/formatter/

Important Notice:
Administrator Rights is required for Windows and Mac OS/macOS to execute SD Memory Card Formatter.

SD Interface Devices

The following interface devices can be used to access SD/SDHC/SDXC memory cards:

- SD Card slot on PC
- USB SD Card reader for USB2.0, USB3.0, USB3.1 & USB-C

Always confirm that the device is compatible with the SD, SDHC or SDXC memory card before formatting.

SD Memory Card Formatter Download for Windows/Mac

For Windows > For Mac >

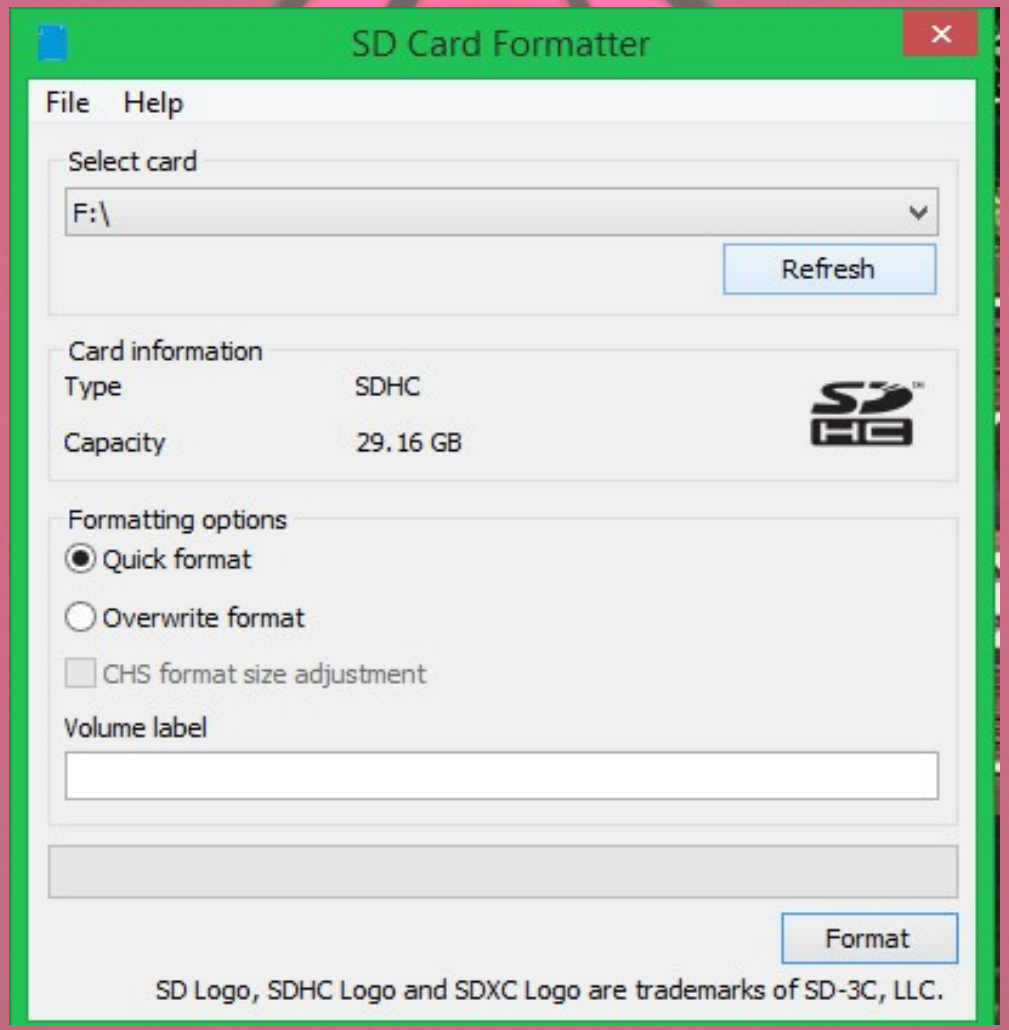
Developed by Tuxera

User's Manual of SD Memory Card Formatter for Windows/Mac

English Japanese

VII. INSTALLING NOOBS ON A RASPBERRY PI

3. Use SD Formatter Card to format SD Card



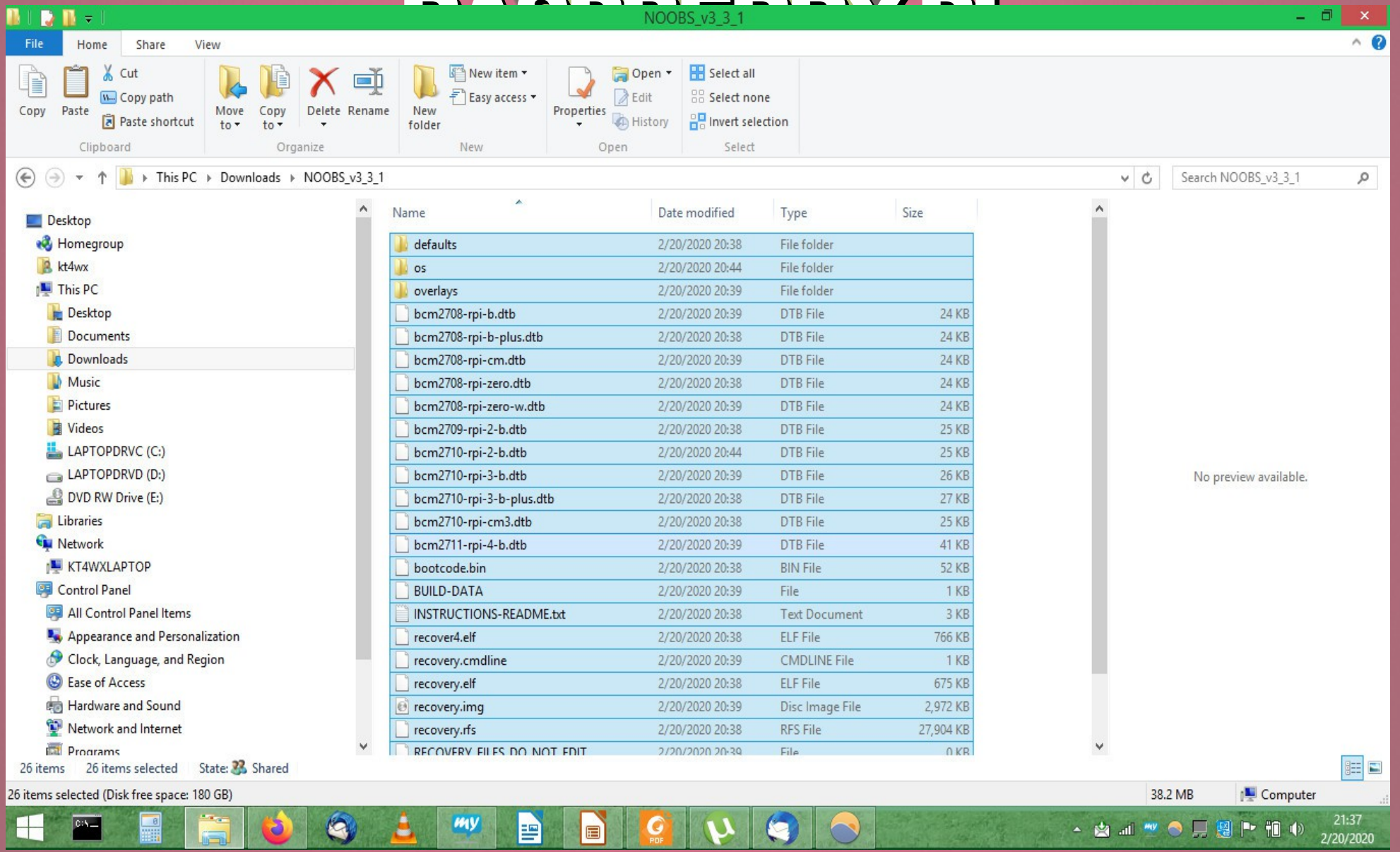
VII. INSTALLING NOOBS ON A RASPBERRY PI

4. Unzip the “NOOBS_v3_3_1”file to predetermined location on your hard drive on your computer.

5. Go to unzipped folder in your computer and copy the files in that folder

6. Paste those files onto the SD Card

VII. INSTALLING NOOBS ON A RASPBERRY PI



VII. INSTALLING NOOBS ON A RASPBERRY PI

7. Remove SD Card from your computer

8. Insert SD Card into your Raspberry PI

9. Power up the Raspberry PI and follow the instructions that you are given in the initial setup on the desktop. This part only has to be accomplished one time.

RESOURCES

- **RASPBERRY PI Main Website:**
  http://www.rapsberrypi.org
  All images used in this program came from this website unless noted on the slide.
- **RASPBERRY Video Tutorials:**

https://www.youtube.com/playlist?list=PLsa31gkylNsly6N_usaeHrtDPYnwxO-1Y

- **Books:**
  - **Raspberry PI User Guide (2nd Edition) by Eben Upton and Gareth Halfacree.**
  - **Raspberry PI for Dummies (3rd Edition) by Sean McManus and Mike Cook**

RESOURCES

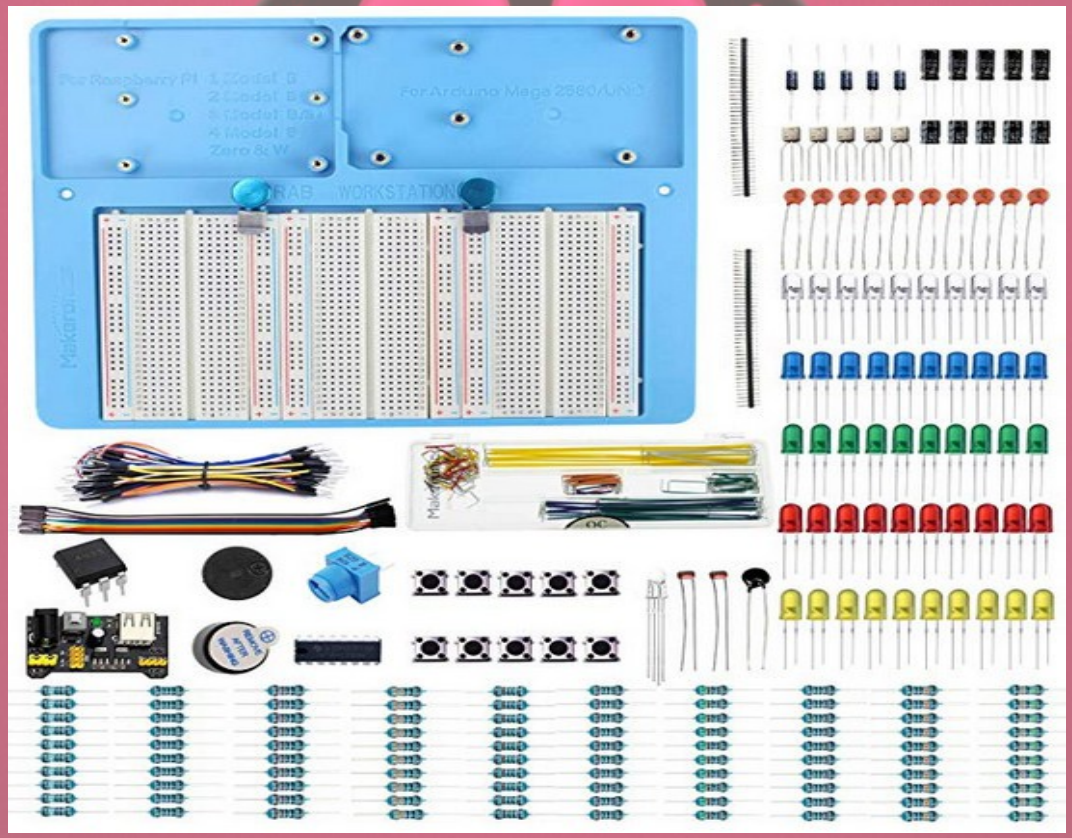
RASPBERRY MAGAZINE: The Mag PI

https://magpi.raspberrypi.org/issues

RESOURCES

MAKERONICS 7 in 1 Blue Breadboard Holder for Raspberry PI 1-4 and or Arduino

Link to Amazon to purchase the Makeronics Board



QUESTIONS AND DISCUSSION

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